024

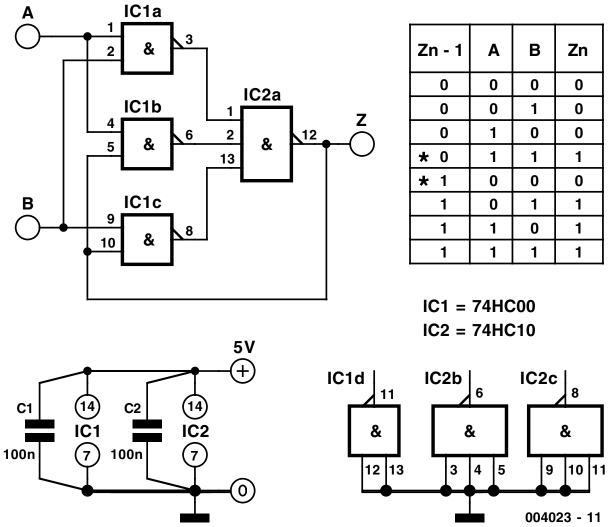
The Muller-C Element

K.-J. Thiesler

The Muller-C element is a special type of flipflop. Its function is that it will only SET its output when all its inputs change to a 1 (on the rising edge). Likewise it will only RESET its output when all its inputs change to a 0 (on the falling edge). All other input combinations will result in no change to its output. **Figure 1** shows an implementation of the circuit using NAND gates. The memory function of the Muller-C element has some distinct advantages over other flipflop configurations:

1. There are no forbidden input combinations as with some other flipflops.
2. The propagation delay through the flipflop will be equal to the delay through only two gates.
3. The Muller-C element does not require an external clock. Its output changes state only when both inputs have a new state. It is self-synchronising.

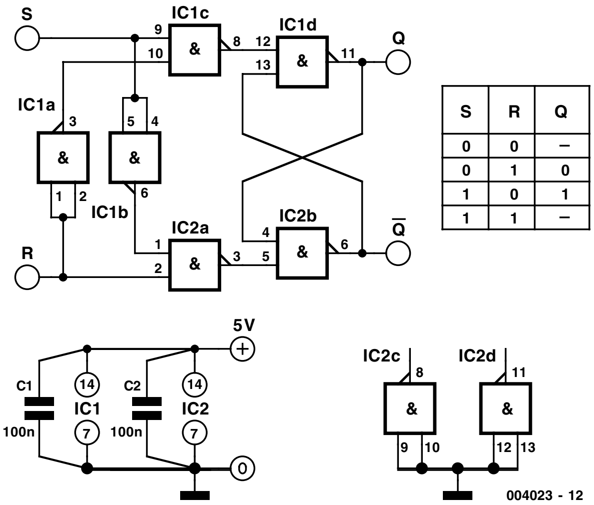
1



Zn - 1	A	B	Zn
0	0	0	0
0	0	1	0
0	1	0	0
* 0	1	1	1
* 1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

IC1 = 74HC00
IC2 = 74HC10

2



S	R	Q
0	0	–
0	1	0
1	0	1
1	1	–

4. In a control circuit using many coupled C elements there will be no clock i.e. in a synchronous system, the clock edges cause many circuit elements to switch at the same time. Careful design is necessary to comply with EMC requirements

Figure 2 shows a Set/Reset flipflop with additional NAND gates to prevent the forbidden input condition. As you can see, it uses more gates than the Muller-C element.

(004023)